

(21) Application No 9028086.8

(22) Date of filing 27.12.1990

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H01R 13/53 13/52(52) UK CL (Edition K)  
H2E ECCC EFAX E202  
U1S S2073(56) Documents cited  
GB 2212992 A EP 0328467 A1 US 4713015 A  
US 4113339 A(58) Field of search  
UK CL (Edition K) H2E EFAF EFAX  
INT CL<sup>5</sup> H01R

## (54) A connector for a high tension lead

(57) A connector for an H T lead (7a) comprises a base (1a) and a cover (9a) for the base. The base (1a) has a hollow insulative tower (2a) defining a longitudinally extending socket (3a) to receive a terminal (5a) on the end of the H T lead (7a). The socket (3a) houses a terminal (4a) to make electrical contact with the terminal (5a). The tower (2a) and cover (9a) each define a number of substantially longitudinally extending laterally spaced surfaces (8a, 8b, 8c & 10a, 10b, 10c) thereon for mutual cooperation together upon fitment of the cover (9a) (Fig. 4). Alternatively, the surfaces are side-by-side (38 to 45, Fig. 7). A clip (26) latches at (27, 28) to the tower (2a), as the terminals (5a, 7a) clip together.

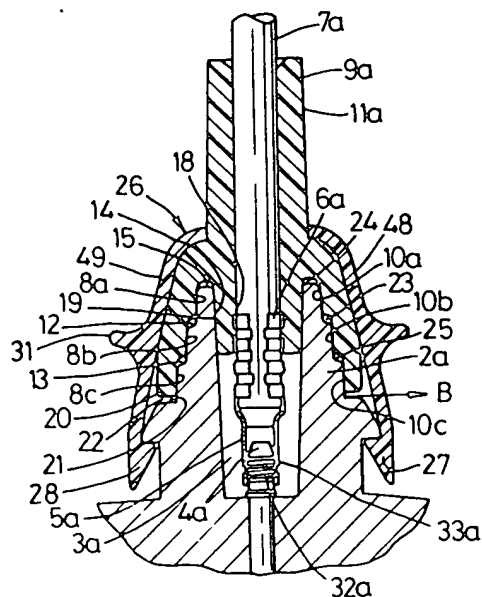


Fig. 4

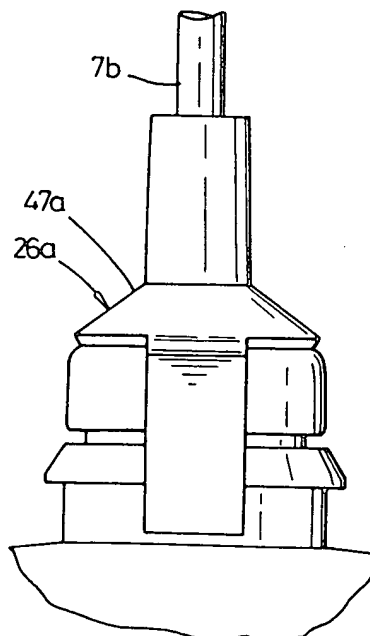


Fig. 5

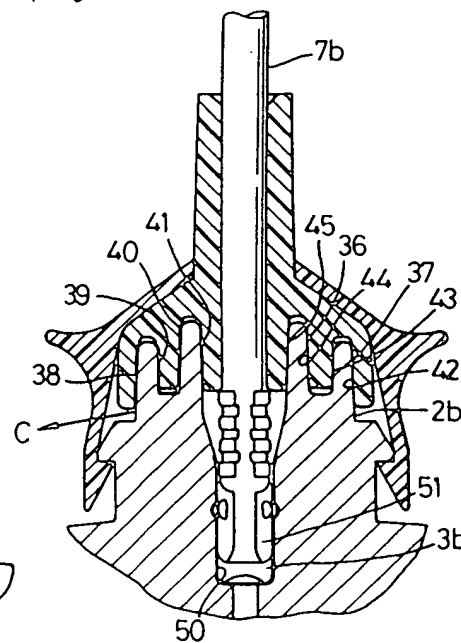
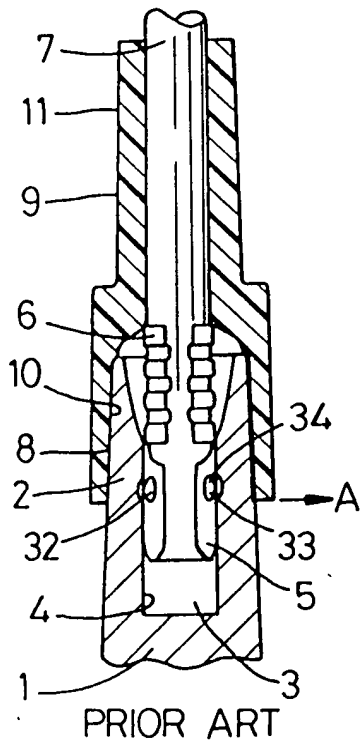


Fig. 7



PRIOR ART

Fig. 1

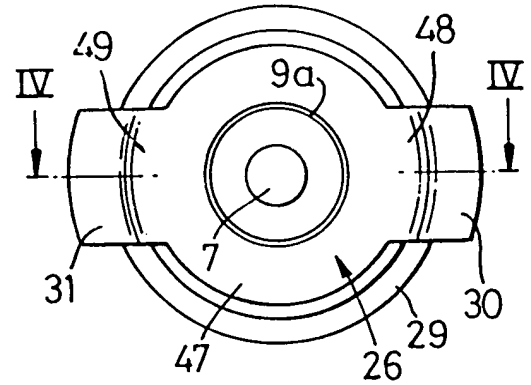


Fig. 3

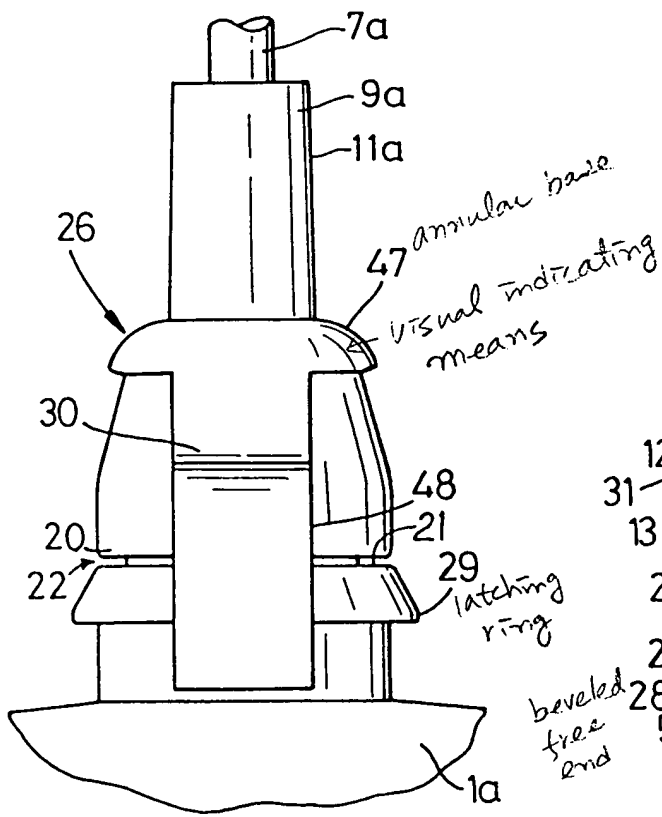


Fig. 2

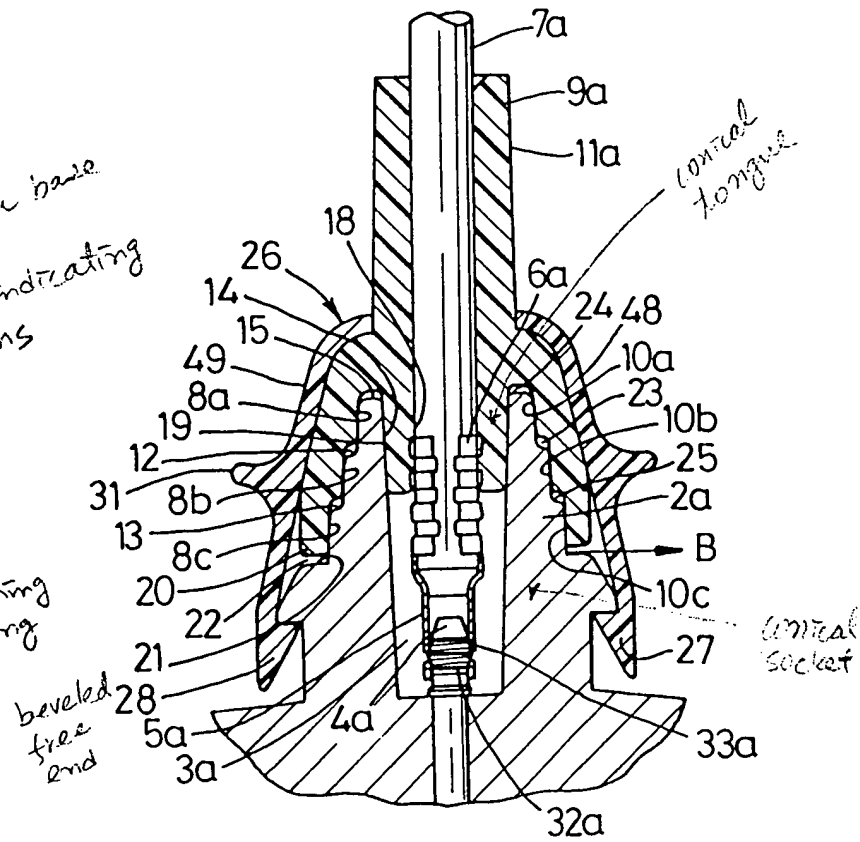


Fig. 4

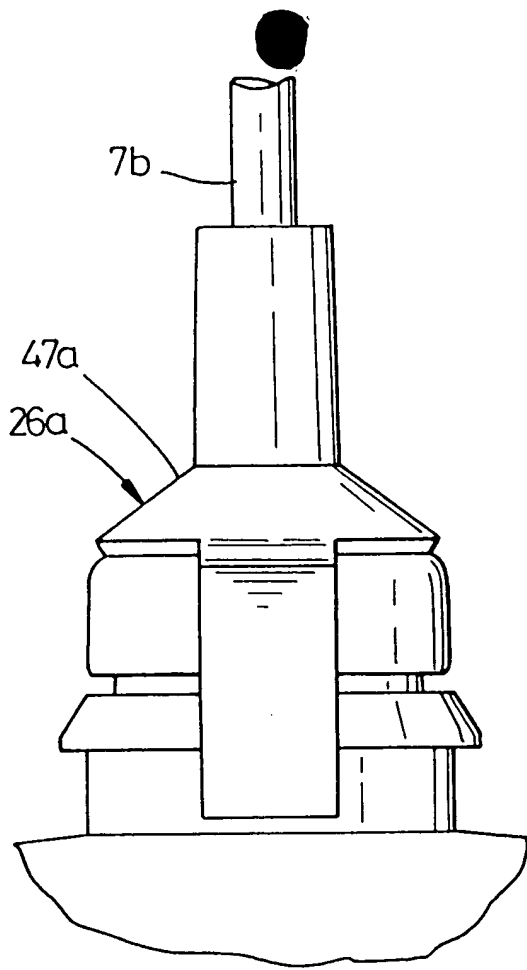


Fig. 5

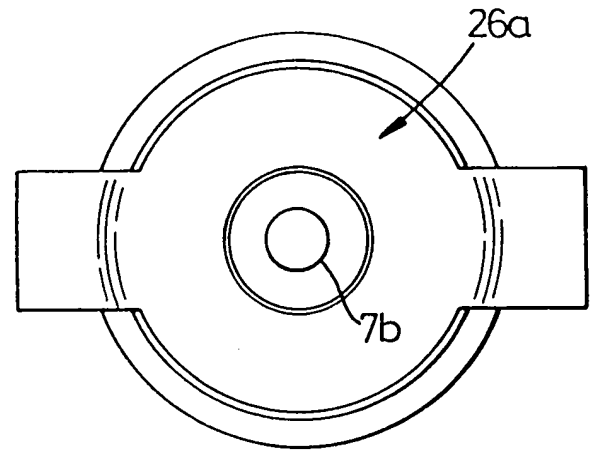


Fig. 6

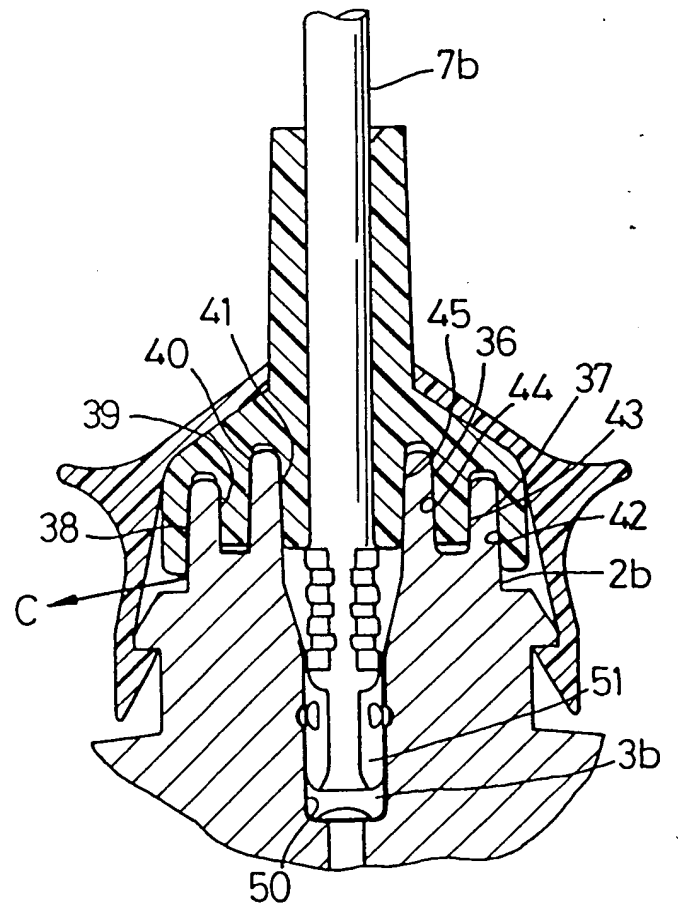


Fig. 7

# A CONNECTOR FOR A HIGH TENSION LEAD

This invention relates to connectors for high tension leads ("H T leads").

An H T lead connector of the type used in internal combustion engines for connecting one end of an H T lead to a coil or distributor, for example, is shown in Figure 1. This comprises a base 1 having a tower 2 of non-conducting material. The tower has a longitudinally extending socket 3 therein. The socket houses a female electrical terminal 4. A male electrical terminal 5 held by crimping 6 thereof on the end of an H T lead 7 is received within the socket 3.

The tower 2 has a longitudinally extending exterior surface 8 over which is fitted a cover 9 of elastomeric material. The cover 9 has a longitudinally extending interior surface 10 which is in mutual cooperation with the exterior surface 8 of the tower. The elastomeric material of the cover 9 is stretched around the tower to form a sealing fit. A sleeve portion 11 of the cover 9 is in sealing engagement with the H T lead 7. The arrow A indicates the shortest electrical tracking path which can be taken by a charge of electricity from the male terminal 5 on the H T lead 7 to earth. Earth, in practical terms, is very often dirt forming a layer on the surface of the base 1 of the connector.

The male and female terminals 5, 4 make snap connection by dimples 32, 33 on the male terminal 5 which engage with a recess 34 on the female terminal 4.

Substantially the full height of the tower needs to be kept clean by the cover to prevent tracking. Because the cover material is resiliently deformable the length of relative sliding length of surfaces which occurs during fitting can cause the material of the cover to compress and turn under at its lip. This can make fitting of the cover extremely difficult and lacking in feel and can result in incomplete fitting and hence incomplete engagement of the terminals.

It is an object of the invention to provide a connector which overcomes the aforementioned disadvantages.

According to the invention there is provided a connector for an H T lead, the connector comprising a base and a cover for the base, the base having a hollow tower of non-conducting material defining a longitudinally extending socket to receive an end of the H T lead, the socket housing an electrical terminal to make electrical contact with the H T lead, wherein the tower and cover each define a number of substantially longitudinally

extending laterally spaced surfaces thereon for mutual engagement upon fitment of the cover.

The fact that a plurality of surfaces are used means that for a given length of tracking path each individual surface can be shorter. Engagement of co-operating surfaces during fitting therefore takes place over a shorter distance and a more positive "feel" results. It will therefore be easier for an operator to judge whether snap engagement of the terminals is about to take place. The shorter distance over which engagement occurs also reduces the likelihood of turning under of the material of the cover during sliding engagement. Also, the lateral spacing of the surfaces adds to the length of tracking path which the tower provides for a given height. The connector of the invention therefore lends itself to use with the higher voltages now demanded for vehicles with high compression ratios, turbochargers and catalytic converters.

Preferably at least two of the surfaces on the tower extend longitudinally successively of one another and may be in stepped relationship to one another.

A neat and compact method of providing laterally spaced surfaces results.

At least two aforesaid surfaces may face laterally outwardly of the tower and the cover may comprise resiliently deformable material which may be stretched over at least two said surfaces upon fitting of the cover.

Such stretching of the material of the cover tends to bind the cover to the tower and prevent unwanted slippage and movement of the cover relative to the base.

At least one surface of the tower engageable by the cover may face laterally inwardly thereof and the tower may comprise a number of upstanding walls extending longitudinally each having at least two opposed said surfaces thereon.

Such an arrangement provides a relatively long tracking path in relation to the height of the tower.

The terminal in the socket may be capable of snap engagement with a mating terminal on the H T lead, for a secure fit, and said snap engagement may be arranged to

occur immediately before longitudinal fitting movement of the cover relative to the base is terminated preferably by limiting means.

Because of the shorter longitudinal distance over which engagement of the cooperating surfaces of the tower and cover takes place greater certainty of correct engagement of the mating terminals is achieved.

The terminal in the socket may comprise a male conducting member extending longitudinally from a base of the socket or may comprise a female conducting member extending longitudinally along a peripheral wall of the socket.

The male terminal is particularly effective in preventing tracking owing to the tracking path extending right to the base of the socket.

The connector may include a retaining clip extending over the cover and engageable with the base of the connector.

Further certainty of complete fitment of the cover to the base is assured when the clip engagement is designed to take place upon full engagement of the cover with the base and/or following snap engagement of the terminals together



and/or upon any limiting means becoming effective.

The retaining clip may have a collar portion to provide support to the cover in the longitudinal direction during fitting and the collar portion may therefore encircle the cover at an end distal from the base when fitted.

The retaining clip may be engageable with the base via at least two resilient arms having engaging means at free ends thereof and at least two of said arms may include ears extending laterally outwardly therefrom to enable the operator to get a better purchase on the clip when fitting the cover.

The present invention will now be described by way of example with reference to the remainder of the accompanying drawings of which:-

Figure 2 is a side elevation of a connector according to a first embodiment of the invention,

Figure 3 is a plan view of the connector of Figure 2,

Figure 4 is a vertical sectional view taken on the line IV-IV of Figure 3,

Figure 5 is a side elevation of a connector according to a second embodiment of the invention,

Figure 6 is a plan view of the connector of Figure 5, and

Figure 7 is a vertical section taken along the line VII-VII of Figure 6

In Figures 2, 3 and 4 the connector has a base 1a surmounted by a tower 2a defining a longitudinally extending socket 3a. The socket 3a houses a male electrical terminal 4a which makes contact with a female electrical terminal 5a attached by crimping 6a to an H T lead 7a.

The tower 2a has three longitudinally extending laterally spaced exterior surfaces 8a, 8b and 8c. These exterior surfaces extend longitudinally successively of one another being in stepped relationship to one another and separated by steps 12, 13. The tower 2a also has an interior surface 14 facing laterally inwardly thereof and a rim 15.

A cover 9a is again of resilient material and has a sleeve portion 11a in sealing engagement with the H T lead 7a and has interior surfaces 10a, 10b and 10c which are longitudinally extending, laterally spaced and laterally inwardly facing.

Tube portion 18 of the cover 9a has a longitudinally extending laterally outwardly directed surface 19. A cover lip 20 is separated from a ledge 21 of the base 1a by a clearance 22. Clearances 23, 24 and 25 also exist between the cover 9a and the tower 2a. A clip 26 of resilient plastics material sits on the cover. The clip has a base portion 47 which encircles the cover and a pair of arms 48, 49 extending therefrom across the surface of the cover. Each arm 48, 49 has engaging means in the form of a jaw 27, 28 on an end thereof which snap engages a ridge 29 around the base 1a of the connector. Each arm 48, 49 also carries an ear 30, 31 projecting outwardly therefrom part way along its length.

The male and female terminals 4a, 5a make snap connection by a spring pin 32a on the female terminal 5a which engages a thread 33a on the male terminal 4a.

It will be observed that an electrical tracking path B is of substantially greater length than the tracking path A of Figure 1. This is in part because of the greater longitudinal extension of the tower 2a than the tower 2 of the prior art, in part owing to the length of the surface 14 as covered by the tube portion 18 on the cover and in part to the lengths of the steps 12, 13 and the ledge 21.

The clearances 23, 24, and 25 between cover and tower ensure that the relationship between cover and tower does not limit interengagement of the male and female terminals, but the steps, ledge and rim 15 act as limiting means to terminate longitudinal fitting movement.

Fitting of the H T lead and cover offers better feel than fitting according to the prior art owing to the configuration of the stepped surfaces 8a, 8b, 8c, 10a, 10b, 10c. These surfaces engage over a substantially shorter longitudinal distance during fitting and snap engagement of the dimples with the recess and engagement of the clip can accordingly be more positively detected. Also, because the longitudinal distance over which engagement of cover and tower occurs is shortened, there is less tendency for the resilient material of the cover to compress and the lip turn under.

The clip also assists in maintaining the form of the skirt whilst frictional resistance is being encountered, the base portion 47 acting as a reinforcing support for the softer material of the cover to provide more positive feel and to assist the cover in retaining its shape during the stretching process which takes place during sliding engagement of the co-operating surfaces together. The two

arms 48, 49 also provide some support for the material of the cover at this stage. Both the base portion 47 of the clip and the ears 30, 31 on the arms provide surfaces to assist an operator to press the cover into position on the base..

The embodiment shown in Figures 5, 6 and 7 works according to the same principle of lateral spacing of mutually cooperating cover and tower surfaces as shown in the first embodiment of the invention. Upstanding walls 36, 37 replace the stepped arrangement of Figures 2, 3 and 4, mutual cooperation of longitudinally extending laterally spaced surfaces 38, 39, 40, 41 of the tower 2b and surfaces 42, 43, 44, 45 of the cover 9b replacing mutual cooperation of surfaces 8a, 8b, 8c, 10a, 10b, 10c and 14, 19 of Figures 2, 3 and 4.

This embodiment features a female terminal 50 housed in the socket 3b making contact with a male mating terminal 51 on the end of an H T lead 7b. This arrangement may equally be fitted to the first embodiment and vice versa. A clip 26a has a wider frustro conical base portion than the first embodiment.

Again, a tracking path C of length considerably increased with respect to that of the prior art is seen to result without undue tower height. Such a design would be appropriate where longitudinal height of tower were significant but where the lateral width of the base were not so important.

CLAIMS

1. A connector for an H T lead, the connector comprising a base and a cover for the base, the base having a hollow tower of non-conducting material defining a longitudinally extending socket to receive an end of the H T lead, the socket housing an electrical terminal to make electrical contact with the H T lead, wherein the tower and cover each define a number of substantially longitudinally extending laterally spaced surfaces thereon for mutual engagement upon fitment of the cover.
2. A connector as in claim 1, wherein at least one said surface of the tower faces laterally inwardly.
3. A connector as in claim 1 or 2, wherein at least two said surfaces are in stepped relationship with one another.
4. A connector as in any preceding claim, wherein at least two said surfaces face laterally outwardly of the tower.

5. A connector as in claim 1 or 2, wherein the tower comprises a number of upstanding walls extending longitudinally each having at least two opposed said surfaces thereon.
6. A connector as in any preceding claim, wherein the cover comprises resiliently deformable material.
7. A connector as in any preceding claim, wherein the terminal is capable of snap engagement with a mating terminal on an H T lead.
8. A connector as in claim 7, wherein the snap engagement is arranged to occur immediately before longitudinal fitting movement of the cover relative to the base is terminated by limiting means.
9. A connector as in any preceding claim, wherein the terminal in the socket comprises a male conducting member extending longitudinally from a base of the socket.



10. A connector as in any preceding claim including a retaining clip extending over the cover and engageable with the base of the connector.
11. A connector as in claim 10, wherein the retaining clip has a collar portion to provide support to the cover in the longitudinal direction during fitting of the cover to the base.
12. A connector as in claim 11, wherein the collar portion encircles the cover at an end distal from the base when fitted.
13. A connector as in claim 10, 11 or 12, wherein the retaining clip is engageable with the base via at least two resilient arms having engaging means at free ends thereof.
14. A connector as in claim 13, wherein at least two of said arms include ears extending laterally outwardly therefrom.
15. A connector as in any of claims 10 to 14, wherein the clip engagement is designed to take place upon full engagement of the cover with the base.

16. A connector as in any of claims 10 to 15 when dependant upon claim 8, wherein the clip engagement is designed to take place upon snap engagement of the terminals together.
17. A connector substantially as described herein with reference to Figures 2 to 4 or 5 to 7 of the accompanying drawings.

**Patents Act 1977**  
**Examiner's report** the Comptroller under  
**Section 17 (The Search Report)**

Application number 9028086.8

**Relevant Technical fields**

(i) UK Cl (Edition K ) H2E (EFAF, EFAX)

(ii) Int Cl (Edition 5 ) H01R

**Databases** (see over)

(i) UK Patent Office

(ii)

**Search Examiner**

F J FEE

**Date of Search**

13 MARCH 1991

Documents considered relevant following a search in respect of claims

1 to 17

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2212992 A (PRESTOLITE)	1 to 6, 10 to 15
X	EP 0328467 A1 (L'ELECTRICFIL)	1 to 3, 5, 6
X	US 4713015 (TAKIGUCHI) Figure 5	1, 2, 6, 9 to 12, 15
X	US 4113339 (ELEY)	1 to 4

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X: Document indicating lack of novelty or of inventive step.

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